

IN THE CLAIMS

We claim:

1. An apparatus for coating a surface of a substrate with a polymer solution comprising:
  - a coating chamber having a rotatable chuck, the rotatable chuck to support a substrate to be coated with a polymer solution;
  - a dispenser to dispense the polymer solution over a surface of the substrate;
  - a vapor distributor communicable with the coating chamber, the vapor distributor including a solvent vapor generator to cause a solvent to be transformed into a solvent vapor, wherein a carrier gas is mixed with the solvent vapor to form a carrier-solvent vapor mixture that is flown into the coating chamber to saturate the coating chamber via the vapor distributor; and
  - a solvent remover communicable with the coating chamber to remove excess solvent that does not get transformed into the solvent vapor to prevent the excess solvent from dropping on the substrate.
2. The apparatus of claim 1 comprising:
  - a fluid sensor placed within the coating chamber to detect the presence of the excess solvent that do not get transformed into the solvent vapor, the fluid sensor capable of causing the solvent remover to remove the excess solvent.
3. The apparatus of claim 1 comprising:

a collector to collect the excess solvent, the collector placed above a coating area within the coating chamber, the collector having a raised edge to prevent the excess solvent from spilling into the coating area; and

a solvent removal line placed in communication with the collector to remove the excess solvent.

4. The apparatus of claim 3 wherein the collector comprises a plurality of grooves.

5. The apparatus of claim 1 comprising:

a showerhead having a plurality of openings, the showerhead being placed above a coating area within the coating chamber, wherein the carrier-solvent vapor mixture flows into the coating area through the plurality of openings to saturate the coating area.

6. The apparatus of claim 5, wherein the plurality of openings in the showerhead have sizes ranging from 0.010  $\mu\text{m}$  to 0.085  $\mu\text{m}$ .

7. The apparatus of claim 1 comprising:

a collector to collect the excess solvent, the collector placed above a coating area within the coating chamber, the collector having a raised edge to prevent the excess solvent from spilling into the coating area;

a solvent removal line placed in communication with the collector to remove the excess solvent;

a showerhead having a plurality of openings, the showerhead being placed above the coating area and below the collector, wherein the carrier-solvent vapor

mixture is flown down from the collector through the plurality of openings of the showerhead to saturate the coating area.

8. The apparatus of claim 1, wherein the solvent distributor comprises a first conduit to receive the solvent to be transformed into the solvent vapor, a second conduit to receive the carrier gas to be mixed with the solvent vapor, and a third conduit to eject the carrier-solvent vapor mixture into the coating chamber.
9. The apparatus of claim 1 further comprises a solvent source and a carrier gas source coupling to the solvent distributor.
10. The apparatus of claim 1 further comprises a container to store the excess solvent removed from the coating chamber.
11. The apparatus of claim 1 further comprises a polymer solution source coupling to the dispenser to dispense the polymer solution over the substrate.
12. The apparatus of claim 1 further comprises a substrate transport door where through the substrate is transferred in and out of the coating chamber.
13. The apparatus of claim 1, wherein the solvent remover comprises a first conduit to receive the excess solvent to be removed from the coating chamber, a second conduit to receive a carrier gas to force the excess solvent out of the coating chamber, and a third conduit to lead the excess solvent vapor into a container.

14. The apparatus of claim 1 wherein the vapor distributor is one of an atomizer and an ultrasonic device.

15. The apparatus of claim 1 wherein the solvent remover is one of an atomizer and an ultrasonic device.

16. A method for coating a surface of a substrate with a polymer solution comprising:

securing a substrate to be coated with a polymer solution in a coating chamber having a rotatable chuck, the rotatable chuck to support the substrate;

generating a carrier-solvent vapor mixture and saturating the coating chamber with the carrier-solvent vapor mixture, wherein a carrier gas is mixed with a solvent vapor to form the carrier-solvent vapor mixture;

removing excess solvent that does not get transformed into the solvent vapor to prevent the excess solvent from dropping on the substrate;

dispensing the polymer solution over a surface of the substrate while the coating chamber is saturated with the carrier-solvent vapor mixture; and

rotating the substrate to spread the polymer solution over the surface of the substrate.

17. The method of claim 16 comprising:

causing a solvent level within the coating chamber to be detected, the solvent being excess solvent that do not get transformed into the solvent vapor;

and

removing the excess solvent by vaporizing the excess solvent.

18. The method of claim 16 comprising:

collecting the excess solvent in a collector above a coating area within the coating chamber, the collector having a raised edge to prevent the excess solvent from spilling into the coating area; and

removing the excess solvent through a removal line placed in communication with the collector to remove the excess solvent.

19. The method of claim 18 wherein the collector comprises a plurality of grooves.

20. The method of claim 16 comprising:

flowing the carrier-solvent vapor mixture into a coating area using a showerhead having a plurality of openings, the showerhead being placed above the coating area within the coating chamber, wherein the carrier-solvent vapor mixture is flown into the coating area through the plurality of openings to saturate the coating area.

21. The method of claim 20, wherein the plurality of openings in the showerhead have sizes ranging from 0.010  $\mu\text{m}$  to 0.085  $\mu\text{m}$ .

22. The method of claim 16 comprising:

collecting the excess solvent in a collector above a coating area within the coating chamber, the collector having a raised edge to prevent the excess solvent from spilling into the coating area;

removing the excess solvent through a removal line placed in communication with the collector to remove the excess solvent; and

flowing the carrier-solvent vapor mixture into the coating area using a showerhead having a plurality of openings, the showerhead being placed above

the coating area within the coating chamber, wherein the carrier-solvent vapor mixture is flown into the coating area through the plurality of openings to saturate the coating area.

23. The method of claim 16, wherein generating the carrier-solvent vapor mixture includes:

introducing the solvent to be transformed into the solvent vapor into a first conduit of a vapor distributor, the vapor distributor including a solvent vapor generator to transform the solvent into the solvent vapor;

introducing the carrier gas into a second conduit of the vapor distributor;

vaporizing the solvent to create the solvent vapor;

mixing the solvent vapor with the carrier gas to create the carrier-solvent vapor mixture; and

introducing the carrier-solvent vapor mixture into the coating chamber to saturate the coating chamber.

24. The method of claim 23 further comprises coupling a solvent source and a carrier gas source to the vapor distributor.

25. The method of claim 16 further directing the excess solvent removed from the coating chamber into a container.

26. The method of claim 16 further comprises coupling a polymer solution source to the dispenser extending into the coating chamber.

27. The method of claim 16, wherein removing the excess solvent that does not get transformed into the solvent vapor further comprises,

introducing the carrier gas into a solvent remover to move the excess solvent into the solvent remover; and

removing the excess solvent into a container.

28. The method of claim 16 further comprises evaporating solvent from the polymer solution dispensed on the surface of the substrate to form a polymer layer on the surface of the substrate.

29. The method of claim 28 wherein the polymer solution is a photoresist solution and the polymer layer is a photoresist film.

30. The method of claim 16 wherein generating the carrier solvent vapor mixture is done using one of an atomizer and an ultrasonic device.

31. The method of claim 16 wherein removing the excess solvent that does not get transformed into the solvent vapor is done using one of an atomizer and an ultrasonic device.

32. An apparatus for coating a surface of a substrate with a polymer solution comprising:

a coating chamber having a rotatable chuck, the rotatable chuck to support a substrate to be coated with a polymer solution;

a dispenser to dispense the polymer solution over a surface of the substrate; and

an ultrasonic device communicable with the coating chamber, the ultrasonic device capable of vaporizing a solvent into a solvent vapor, wherein a carrier gas is mixed with the solvent vapor to form a carrier-solvent vapor mixture that is flown into the coating chamber to saturate the coating chamber via the ultrasonic device.